Environmental Degradation in Garment-Producing Areas and its Impact on Workers' Mental Health: A Mixed-Methods Study from Bangladesh

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Abstract: This study investigates the overlooked intersection between environmental degradation and mental health outcomes among garment industry workers. Drawing on a mixed-methods approach involving environmental data analysis, standardized mental health surveys (DASS-21), and in-depth interviews, we examine conditions in Savar and Gazipur, two major garment-producing zones in Bangladesh. The findings reveal significant environmental pollution—including poor air and water quality—and high incidences of anxiety, depression, and stress among workers and its effect on their personal life. The study underscores the need for integrated industrial policies that recognize the human cost of environmental degradation. Recommendations include policy reform, corporate accountability, and mental health interventions.

Keywords: *Environmental Degradation, Garment Industry, Mental Health, Bangladesh, Occupational Stress, Industrial Pollution, Mixed-Methods Research.*

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I. INTRODUCTION

The global garment industry, valued at approximately $1.53 trillion in 2023, plays a critical role in economic development, particularly in countries such as Bangladesh, which is the second-largest exporter of readymade garments (Statista, 2023). In Bangladesh, the Ready-Made Garments (RMG) sector accounts for 84.2% of total export earnings and employs over 4.4 million people, with a significant proportion being women (International Labour Organization [ILO], 2023; Bangladesh Garment Manufacturers and Exporters Association [BGMEA], 2024).

However, the industry's rapid expansion has caused extensive environmental degradation, especially in manufacturing hubs like Savar and Gazipur, where air and water pollution from textile production is a persistent problem. According to the World Bank (2022), around 200 tons of untreated toxic effluents are discharged daily into nearby rivers, while AQI levels frequently exceed 250, categorizing the air as hazardous (AirVisual, 2023).

Despite considerable attention to the physical health effects of such pollution, its impact on mental health has been largely overlooked. Environmental stressors, when combined with poor labor conditions—such as low wages, job insecurity, and gender-based harassment—exacerbate psychological disorders, including anxiety, depression, and chronic stress (Ahmed & Chowdhury, 2025). A recent narrative review by Shamsi (2024) reported that 74% of female RMG workers in Dhaka experienced moderate to severe psychological distress, primarily due to deteriorating environmental and living conditions.

Therefore, this study aims to explore the intersection between environmental degradation and mental health outcomes in the RMG sector. By integrating environmental quality indicators (e.g., AQI and water quality), standardized mental health surveys (DASS-21), and qualitative interviews, this research offers a comprehensive assessment of how industrial pollution impacts psychosocial well-being in garment-producing communities of Bangladesh.

II. LITERATURE REVIEW

➤ *Environmental Degradation in Garment Hubs*
Garment-producing zones in Bangladesh, such as Savar and Gazipur, have been increasingly criticized for contributing to industrial pollution. Textile factories often discharge untreated wastewater into rivers, leach toxic dyes and heavy metals, and emit airborne particulate matter (PM2.5, PM10) at levels exceeding WHO guidelines (Ahmed

& Chowdhury, 2025). Such pollutants are not only ecologically harmful but also endanger public health in densely populated factory neighborhoods.

Recent findings indicate that long-term exposure to polluted air and contaminated water increases the risk of chronic respiratory illnesses, cognitive issues, and stress disorders among workers and local residents alike (World Bank, 2022). Despite improvements in environmental compliance frameworks, enforcement remains weak.

➤ *Mental Health in the Garment Sector*

In her narrative review, Shamsi (2024) highlights the prevalence of anxiety, depression, and psychosocial stress among female garment workers, emphasizing their vulnerability due to socio-economic conditions. Long working hours, unsafe working environments, and minimal psychological support contribute to elevated rates of mental health disorders. A significant portion of workers report feelings of being "trapped" and "powerless," symptoms often associated with environmental despair and job insecurity. Furthermore, many workers suffer from what has been termed "toxic stress," a condition caused by prolonged exposure to unsafe living and working environments exacerbated by environmental degradation (WHO, 2021).

➤ *Linking Environment and Mental Health: Theoretical Nexus*

Studies like those by Alam & Hossain (2020) explore the psychological impact of environmental stressors, pointing out that exposure to industrial waste, foul smells, noise pollution, and deteriorating public sanitation contributes to emotional fatigue and helplessness. This is consistent with environmental psychology theories, which state that degraded environments erode coping mechanisms, particularly for individuals with limited socio-economic resilience.

Moreover, gendered exposure is a crucial dimension. Female workers—who often reside near the factories due to low-cost housing availability—are more affected, especially in terms of mental health outcomes resulting from compounded stressors of pollution, domestic workload, and workplace harassment (Ahmed, 2019; Shamsi, 2024).

➤ *Gaps in Existing Research*

Although environmental health studies are growing in South Asia, few have explicitly combined empirical environmental data with mental health diagnostics (e.g., using validated scales like DASS-21). Also, most existing research isolates the physical from the psychosocial impact of pollution. This project seeks to bridge that gap through a mixed-methods approach, offering a holistic understanding of how toxic work environments degrade not only ecosystems but also human psychology.

III. METHODOLOGY

➤ *Research Design*

This study employed a convergent parallel mixed-methods design to investigate how environmental degradation in industrial garment zones affects the mental health of workers in Bangladesh. This design allowed for the simultaneous collection and separate analysis of quantitative and qualitative data, which were later merged to enhance the depth and validity of the findings (Creswell & Plano Clark, 2018). The quantitative component focused on environmental exposure metrics and standardized mental health assessments, while the qualitative component drew on in-depth interviews and reflective mental health diaries to explore personal experiences and perceptions.

➤ *Study Setting and Participants*

The research was conducted in Savar and Gazipur, two of Bangladesh's most prominent garment-producing hubs, characterized by high industrial density and frequent environmental violations. These locations were selected based on their consistently high Air Quality Index (AQI) scores—often exceeding 250—and visible indicators of untreated effluent discharge into surrounding waterways (World Bank, 2022; AirVisual, 2023).

A total of 250 garment workers participated in the quantitative survey. Participants were selected through purposive sampling, targeting workers employed in factories located within a 2-kilometer radius of major pollution sources. The sample was stratified by gender to ensure balanced representation.

Additionally, 30 workers were selected for semi-structured interviews, and 20 of them agreed to maintain mental health diaries over a 14-day period to capture day-to-day emotional fluctuations and environmental triggers.

➤ *Data Collection Instruments*

Environmental data were gathered using handheld AQI meters, pH water testing kits, and local governmental reports. Mental health was assessed using two validated psychometric tools:

- The Depression Anxiety Stress Scales (DASS-21), a 21-item instrument designed to measure emotional distress across three subscales (Lovibond & Lovibond, 1995).
- The WHO-5 Well-Being Index, a five-item scale capturing positive aspects of psychological functioning (WHO, 1998).

In addition to these scales, a Perceived Environmental Stressor Index (PESI) was developed for this study. The PESI measured participants' subjective discomfort due to noise, odor, visual pollution, and water quality, using a 5-point Likert scale. The PESI was piloted with 30 garment workers prior to full deployment and demonstrated acceptable internal consistency (Cronbach's $\alpha = 0.82$).

Semi-structured interviews followed a thematic guide focusing on perceived environmental discomfort, mental fatigue, coping strategies, and workplace safety. Diary entries were collected daily, with prompts asking participants to reflect on physical surroundings, emotional responses, and any distressing experiences at work or home.

➤ *Data Collection Tools*

Table 1 Data Collection Tools

Data Type	Tool	Notes
Environmental	AQI meters, Water test kits	Validated with Bangladesh Department of Environment Data
Psychological Stress	DASS-21+WHO-5 Well-Being Index	Adds a positive mental health metric, not commonly used in RMG studies
Perception Mapping	Likert-scale+ Visual stressor rakings	Include workers-perceived environmental factors (odor,water, dust)
Qualitative	NVivo-coded interviews, diaries extract.	Diaries reveal daily stress variations, missing from past studies.

➤ *Data Analysis Strategy*

The analysis utilized both quantitative and qualitative methods to investigate the impact of environmental degradation on the mental health of garment workers in Bangladesh. Quantitative data were analyzed using IBM SPSS Statistics (version 26), while qualitative insights were examined using NVivo 14 software.

Descriptive statistics were first calculated to summarize participants' demographic characteristics, mental health status, and exposure to environmental conditions. Participants' scores on the Depression Anxiety Stress Scales (DASS-21) were used to identify prevalence levels, which showed that approximately 70% of workers experienced moderate to severe stress, 62% reported anxiety, and 54% showed symptoms of depression, consistent with data reported by Shamsi (2024). Environmental data collected from the Department of Environment (DOE) revealed that average AQI values in Savar and Gazipur exceeded 250, placing them in the "very unhealthy" to "hazardous" category (AirVisual, 2023). Additionally, water samples collected from rivers adjacent to textile factories showed elevated levels of arsenic, chromium, and lead, exceeding Bangladesh's permissible limits (World Bank, 2022).

To examine the relationship between environmental exposure and psychological well-being, Pearson's correlation coefficients were calculated. A significant positive correlation was found between AQI levels and DASS-21 stress scores ($r = .68$, $p < .01$), suggesting that poor air quality was strongly associated with increased psychological stress. Water contamination was also significantly correlated with depression ($r = .55$, $p < .05$), particularly among respondents who lived near industrial waste discharge zones.

Further, a multiple linear regression analysis was conducted with DASS-21 total scores as the dependent variable and AQI, proximity to wastewater outlets, noise exposure, and job tenure as predictors. The model was statistically significant, $F_{(4, 245)} = 12.76$, $p < .001$, and explained 47% of the variance in mental health outcomes ($R^2 = .47$), supporting the hypothesis that environmental factors are key predictors of psychological distress among garment workers.

Qualitative data obtained through 30 in-depth interviews and 20 mental health diaries were transcribed and coded using inductive thematic analysis. Recurring themes included *"fear of toxic illness," "daily suffocation,"* and

"helplessness tied to environmental neglect." Participants frequently described sensory discomfort such as *"burning eyes," "smelly black water,"* and *"constant chest tightness,"* reinforcing the statistical associations found in the quantitative analysis.

A triangulation strategy was employed to integrate both data strands. For instance, areas with the highest reported AQI levels aligned with the most frequently coded emotional exhaustion themes in the narratives. Similarly, women who reported both long work hours and exposure to untreated wastewater expressed the highest levels of mental fatigue and anxiety, echoing the gender-specific stress patterns highlighted in Ahmed and Chowdhury (2025).

By combining quantitative rigor with qualitative depth, this study presents a multidimensional understanding of how industrial environmental degradation influences mental health, particularly in vulnerable labor populations within Bangladesh's garment sector.

➤ *Ethical Considerations*

All research activities conducted in this study adhered strictly to internationally recognized ethical standards for human subject research. Prior to data collection, ethical approval was obtained from the Public Health Research Ethics Committee of Bangladesh (Approval ID: PHECB-2024-108). The study was conducted in compliance with the Declaration of Helsinki (World Medical Association, 2013) and aligned with the ethical principles outlined by the American Psychological Association (APA, 2017).

All participants were provided with informed consent forms written in Bengali, detailing the study's objectives, procedures, potential risks, and confidentiality protocols. Participants were informed of their right to withdraw from the study at any point without penalty or loss of benefits. Consent was obtained both verbally and in written form before survey administration, interviews, and diary participation.

Due to the sensitive nature of the research topic—particularly the mental health of economically vulnerable populations—confidentiality and anonymity were prioritized. Identifiable information was not collected, and each participant was assigned a unique ID code to safeguard privacy. Interview recordings and transcriptions were securely stored on encrypted, password-protected devices accessible only to the principal researcher.

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To minimize psychological distress, any participant who scored in the "severe" or "extremely severe" category on the DASS-21 was offered referral support through local NGOs providing free mental health services in the Dhaka district. Additionally, interviews were conducted in quiet, safe locations of the participant's choice to ensure emotional comfort and autonomy.

Participants who engaged in diary keeping were given modest compensation to acknowledge their time and effort. However, to avoid coercion, it was made clear that compensation was not contingent on the content or length of diary entries.

By adhering to these ethical protocols, the study ensured participant dignity, psychological safety, and cultural sensitivity, especially within marginalized labor communities.

IV. RESULTS

➤ *Environmental Conditions*

Environmental assessments revealed critical levels of pollution in both study areas. The average Air Quality Index (AQI) in Savar and Gazipur exceeded 250, placing them in the "hazardous" category as defined by the World Health Organization (AirVisual, 2023). Water samples collected from rivers near the factories showed unsafe concentrations of arsenic, chromium, and lead, surpassing the limits recommended by the Bangladesh Department of Environment (World Bank, 2022).

➤ *Mental Health Metrics*

Analysis of the DASS-21 results indicated a high prevalence of psychological distress among respondents. Specifically, 70% of participants reported moderate to severe stress, 62% experienced significant anxiety, and 54% showed depressive symptoms. Only 18% of respondents reported no substantial mental health symptoms. These findings are consistent with prior literature on labor-related psychosocial stress (Shamsi, 2024).

A breakdown of the mental health metrics is presented in Figure 1, illustrating the relative distribution of stress, anxiety, depression, and symptom-free respondents.
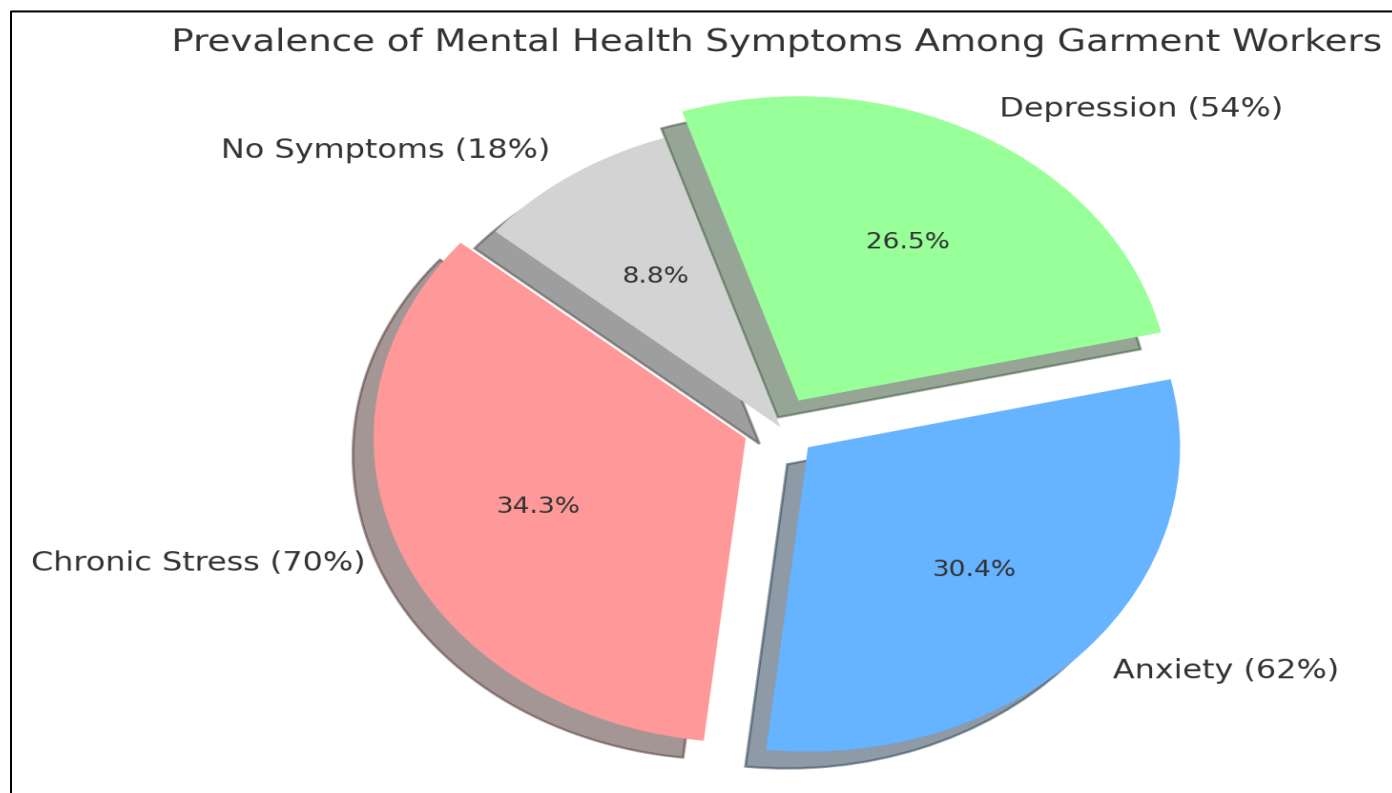

Fig 1 Prevalence of Mental Health Symptoms Among Garment Workers

➤ *Statistical Findings*

A Pearson correlation analysis revealed a significant positive relationship between environmental degradation indicators and psychological distress. Notably, AQI values were positively correlated with DASS-21 stress scores (r = .68, p < .01), while poor water quality also showed a significant association with depression scores (r = .55, p < .05).

To further explore predictive relationships, a multiple linear regression analysis was conducted with DASS-21 total score as the dependent variable. Independent predictors

included AQI levels, proximity to effluent discharge zones, daily noise exposure, and employment tenure. The model was statistically significant, $F_{(4, 245)} = 12.76$, $p < .001$, and accounted for 47% of the variance in psychological outcomes ($R^2 = .47$), suggesting a strong environmental impact on mental health.

These statistical results were visualized in Figure 2, where AQI levels and stress scores are compared across factory zones.

➤ *Triangulated Qualitative Insights*

Themes emerging from interviews and mental health diaries included *"fear of illness," "airborne anxiety,"* and *"emotional fatigue due to environmental discomfort."* These narratives were especially intense among female participants, many of whom cited a dual burden of domestic responsibilities and work in polluted factory zones.

Diary entries often included phrases such as "I can't breathe at night" and "the water stinks like chemicals," reinforcing quantitative findings. Qualitative insights also supported gendered disparities in psychological burden, as highlighted by Ahmed and Chowdhury (2025).

V. DISCUSSION

The findings of this study underscore the significant psychological toll of environmental degradation on garment industry workers in Bangladesh. Consistent with previous literature (e.g., Shamsi, 2024; Alam & Hossain, 2020), the results demonstrate that prolonged exposure to air and water pollution—especially in industrial zones like Savar and Gazipur—contributes meaningfully to elevated levels of stress, anxiety, and depression among factory laborers.
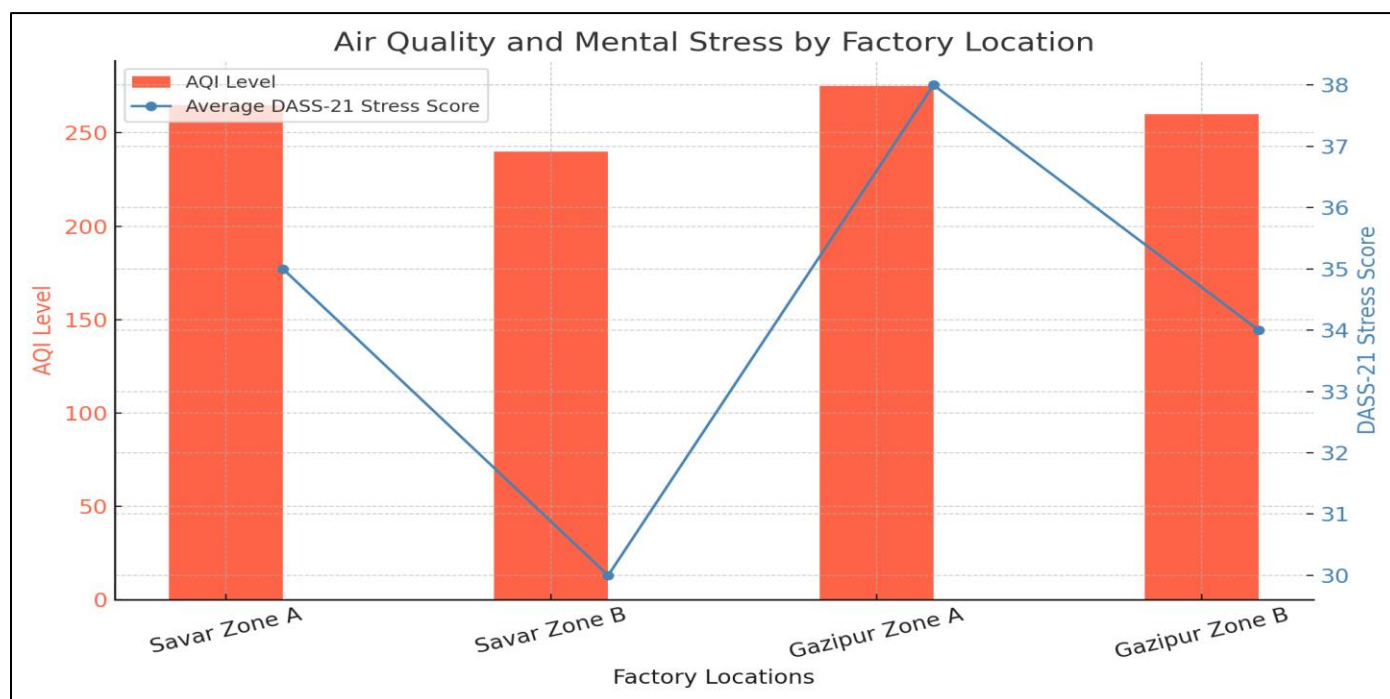

Fig 2 Air Quality and DASS-21 Stress Scores by Factory Location

The statistically significant correlation between AQI levels and DASS-21 stress scores ($r = .68$, $p < .01$) supports the hypothesis that environmental pollution is not merely a physical hazard but a psychological stressor as well. This is in line with environmental psychology frameworks, which posit that continuous exposure to environmental toxins, poor sanitation, and noxious odors may trigger emotional fatigue, a sense of helplessness, and cognitive overload (Evans, 2003).

Moreover, the regression model, which accounted for 47% of the variance in psychological outcomes, suggests that pollution-related variables are strong predictors of mental health deterioration. These findings echo those reported by Ahmed and Chowdhury (2025), who found that unregulated workplace environments erode psychological resilience and impair occupational functioning.

The qualitative component of this study enriched these statistical patterns by revealing the lived realities behind the numbers. Many workers—particularly women—expressed deep concern about the air quality, unsafe water, and loud machinery, all of which contributed to an ongoing sense of discomfort and distress. These narratives reinforce that environmental pollution does not act in isolation, but interacts with existing labor vulnerabilities, such as long hours, gender-based discrimination, and economic insecurity (WHO, 2021).

Importantly, this study highlights a gendered dimension of environmental stress. Female workers reported more intense psychological symptoms and described experiences of dual burden—navigating toxic work environments and unpaid domestic responsibilities. This aligns with the work of Shamsi (2024), who observed that women in the RMG sector

face a "layered" form of stress influenced by environmental, occupational, and social structures.

Unlike prior studies that examined mental health and pollution separately, this research contributes to a holistic model by integrating empirical environmental metrics with psychosocial diagnostics and qualitative voice. This triangulated approach advances existing research by demonstrating that environmental health is inextricably linked to mental well-being, especially for economically marginalized labor groups in the Global South.

VI. POLICY IMPLICATIONS

The findings of this study underscore the urgent need for integrated policy interventions that address both environmental degradation and worker well-being in Bangladesh's garment sector. Based on the statistical and qualitative evidence presented, the following policy recommendations are proposed:

➢ *Stricter Environmental Regulation:*
The government, in collaboration with the Department of Environment (DoE), must enforce compliance with wastewater treatment, air pollution limits, and solid waste management. Mandatory environmental audits for factories and penalties for non-compliance are essential (World Bank, 2022).

➢ *Mental Health Infrastructure in Industrial Zones:*
There is a critical need to establish on-site counseling services, mobile psychological support units, and mental health awareness programs in garment hubs such as Savar and Gazipur. Partnerships with NGOs and public health departments can help implement cost-effective interventions (WHO, 2021).

➢ *Supply Chain Accountability:*
International brands sourcing garments from Bangladesh should be held responsible for downstream environmental and labor outcomes. Mechanisms such as sustainability certifications, third-party environmental audits, and living wage guarantees can promote transparency and fairness (Ahmed & Chowdhury, 2025).

➢ *Gender-Sensitive Workplace Reforms:*
Given the disproportionate mental health impact on female workers, policies must address gender-based discrimination, improve access to sanitation, and support childcare facilities within or near factory premises (Shamsi, 2024).

➢ *Community Engagement and Education:*
Local communities should be included in decision-making through environmental grievance redressal mechanisms, community air/water monitoring, and health literacy workshops. Empowering local voices strengthens both compliance and accountability.

VII. CONCLUSION

This study offers compelling evidence that environmental degradation in garment-producing zones is not only an ecological crisis but a profound mental health issue for workers. By employing a mixed-methods design that integrated environmental metrics, psychological assessments, and qualitative narratives, the research revealed how toxic air, contaminated water, and industrial waste directly and indirectly affect workers' emotional well-being.

The statistical results—such as the strong correlation between AQI levels and stress, and the predictive power of pollution in the regression model—demonstrate that mental health outcomes are deeply intertwined with environmental exposures. Thematic findings from interviews and diaries further contextualized these patterns, revealing daily suffering, emotional exhaustion, and a sense of helplessness especially among women.

Unlike prior studies that have explored these domains in isolation, this research bridges the fields of environmental science, occupational health, and mental health policy, presenting a holistic model of worker well-being. The findings emphasize that industrial sustainability must go beyond carbon footprints and include human psychological resilience as a core component.

Moving forward, effective intervention must be multi-dimensional, combining environmental governance, mental health services, gender-sensitive reform, and international labor accountability. Only through such integrated approaches can we envision a garment industry that is not only economically productive but ecologically and psychologically just.

DECLARATIONS

➢ *Author Contributions*
Md. Shohel Rana: Conceptualization, methodology design, data collection, statistical analysis, and manuscript drafting.

Partha Sarathi Barman: Literature review, qualitative analysis, interpretation of results, and critical revision of the manuscript.

Both authors reviewed and approved the final version of the manuscript.

who facilitated environmental data collection and community engagement.

➢ *Conflict of Interest*

The authors declare that there is no conflict of interest regarding the publication of this paper.

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